Technology Opportunity

Coatings for High-Temperature Environmental Durability of Structural Materials

The National Aeronautics and Space Administration (NASA) seeks to transfer the technology for utilizing various coatings to achieve environmental durability of components operating at high temperatures. Coatings can be applied to achieve thermal, oxidation, corrosion, and wear/erosion resistance of advanced metal, ceramic, polymer and composite structural materials.

Potential Commercial Uses

- Aerospace powerplant and land-based power generation engine hot section components
- Diesel engine piston heads
- Petroleum and chemical industry manufacturing
- Repair/maintenance of in-service components

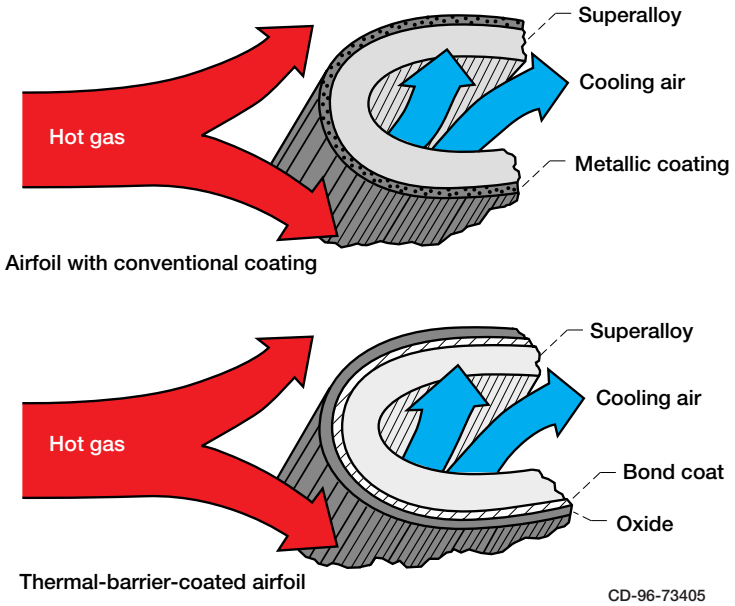
Benefits

- Higher operating temperatures often make processes more efficient
- Longer component lifetimes
- Reduced downtime due to maintenance
- Greater flexibility in structural material options

The Technology

High-temperature structural systems must be protected from the severe conditions imposed by their operating environments. Coatings for thermal and environmental resistance are an enabling technology for many aerospace and land-based applications. Members of the Environmental Durability Branch at NASA Glenn are experts at effective

Thermal Barrier Coatings Insulate Air-Cooled Turbine Airfoils in Advanced Gas Turbine Engines



utilization of coating technologies. Ceramic thermal barrier coatings for aerospace and automotive engine components, and protective overlay coatings for use in aggressive environments, diffusion barrier and tailored interface coatings have been successfully developed, characterized, and applied to practical engineered systems requiring extended durability.

Coatings are effective when their inherent or synergistic properties, with the component materials, result in protection against the operating environment. In thermal barrier coatings (TBC's), a low-thermal-conductivity ceramic layer is applied to the hot surfaces of a cooled component by plasma spraying or electron beam physical vapor deposition. Because heat transfer through the coating is reduced, the components have lower temperatures, which results in increased component lifetime or higher system operating temperatures. For environmental resistance, a coating may be applied by a variety of deposition techniques. They provide greater resistance than the component material alone, to degradation (e.g., by oxidation and/or corrosion), because the coating can form a uniform protective oxide scale. Testing in burner rigs, furnaces, and other simulated environments, followed by detailed characterization and life modeling, provide the necessary design data to implement the specific coating technology. In many cases, the technologies are mature enough that development resources can be reduced when they are applied to new systems.

Options for Commercialization

The primary bill-of-materials TBC composition was developed by NASA Glenn. In addition to the materials and processes, NASA Glenn has developed the industry standard for a plasma-sprayed TBC life prediction model, demonstrating our expertise/capabilities in analytical methods.

High-temperature, oxidation-resistant coating materials, direct access to plasma spray and chemical/physical vapor deposition techniques, unique environmental testing facilities and characterization methods, and analytical modeling are some of the many capabilities that can be offered to meet the customers' requirements.

Contact

Commercial Technology Office
Attn: TOPS
NASA John H. Glenn Research Center
at Lewis Field
Mail Stop 7–3
Cleveland, OH 44135–3191
Phone: (216) 433–3484
Fax: (216) 433–5012
E-mail: cto@grc.nasa.gov
http://cto.grc.nasa.gov

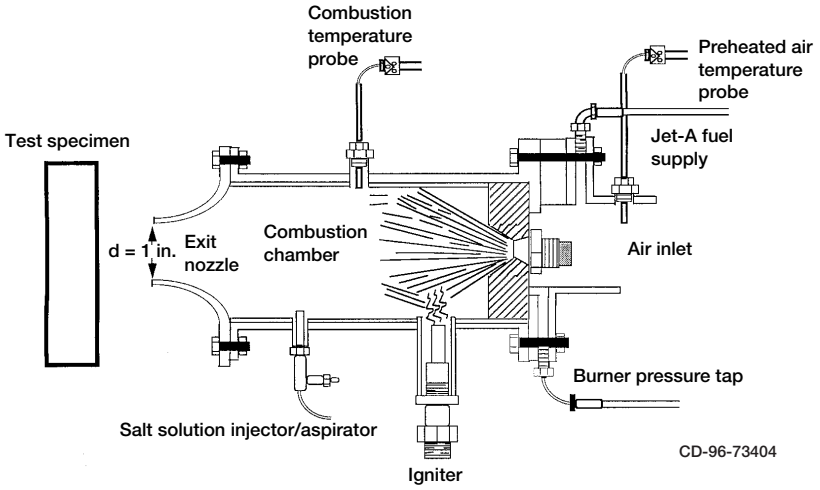
Key Words

Coatings
High-temperature materials
Thermal barrier coatings
Oxidation resistance
Corrosion resistance
Wear/erosion resistance
Diffusion barrier coatings

References

LEW 15164-2, LEW 15273-1, LEW-15268-1, LEW 15154-2, LEW 15561-1, LEW 15561-2, LEW 15164-1, LEW 15155-1, LEW 16209-1, LEW 16390-1, MS 100-1

Mach 0.3 Burner Rig



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Glenn Research Center